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# The Fundamentals of Asset Management

*Executive Overview*

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*A Hands-On Approach*

# Emerging utility business conditions

- Increasing demand for utility services
- Diminishing resources
- Leveling of production efficiencies
- Increasing restrictions on output
- Aging infrastructure

Result: *increasingly expensive treatment options*

# Emerging utility business conditions

- Aging customer base
- Diminishing technical labor pool
- Larger and more sophisticated facilities
- Loss of knowledge with personnel retirements
- Public resistance to rate increases

Result: *increasingly complex management environment*

# Changing utility business environment

- Demand to do more with existing resources
- Need to make every dollar work – to better use capital and operating budgets
- Move from *reactive* to *proactive* work environment

# A paradigm shift...

- Transition from *building and operating* to *managing* assets
  - Extending asset life
  - Optimizing maintenance and renewal
  - Developing accurate long-term funding strategies
  - *Sustain long term performance!*

Infrastructure is the foundation to sustained quality of life



# Consequences of asset failure can be severe



# Asset management improves...

Decision making throughout the life cycle of the asset

- Acquisition
- Operations
- Maintenance
- Renewal

Resulting in *lowest total cost of ownership*

# This training describes...

- *What* is asset management?
- *Why* do it?
- What *deliverables* do I get from it?
- What are the *steps*?
- *How* do I move my organization forward?

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# Views on asset management

- Life cycle
- Conceptual framework
- Charter principles
- Asset management plan

# What is asset management (AM)?

- Systematic integration of advanced and sustainable management techniques into a management paradigm or *way of thinking*, with
- Primary focus on the *long-term life cycle* of the asset and its sustained performance, rather than on short-term, day-to-day aspects of the asset

# Views on asset management – a framework

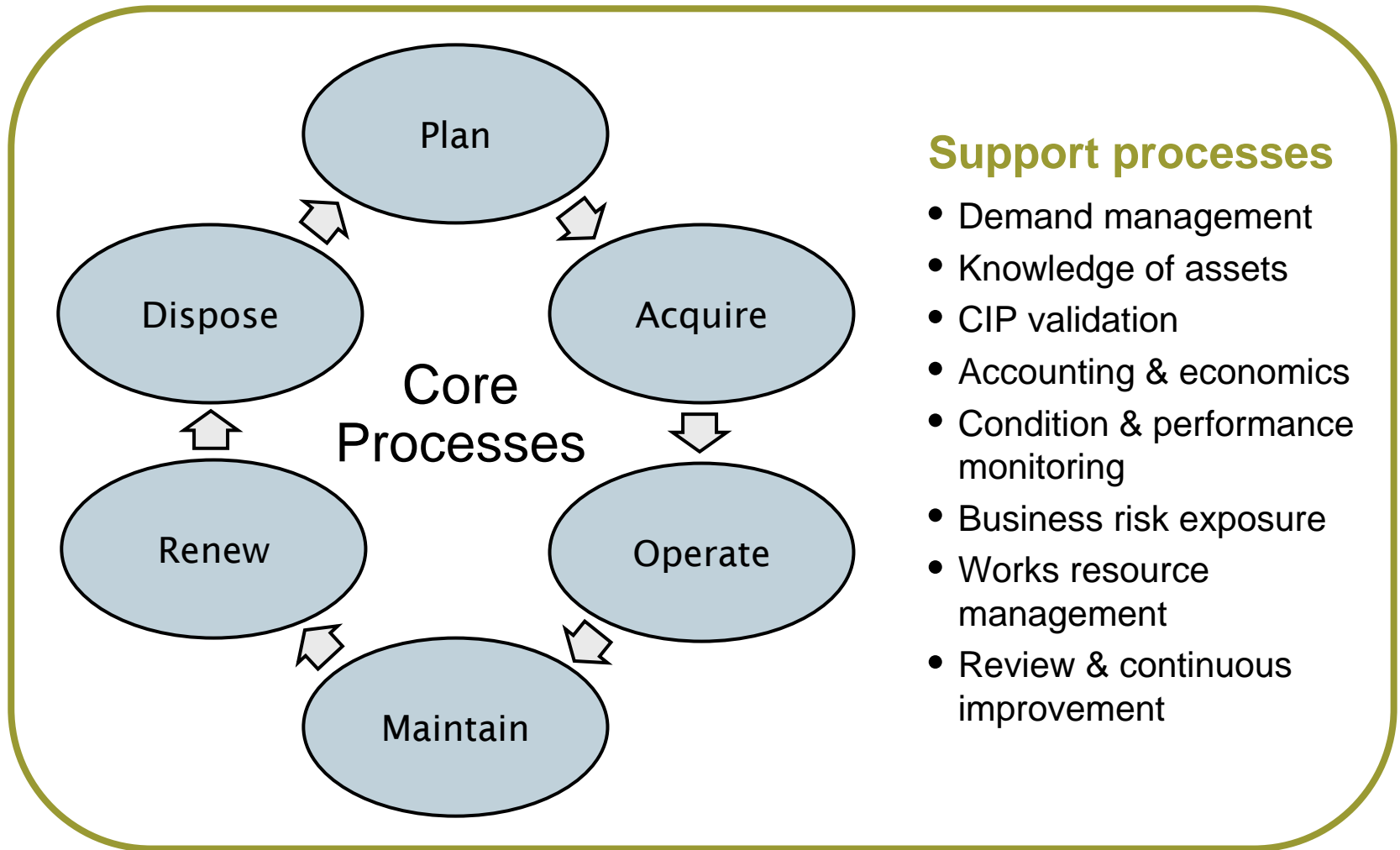
- Asset management can be thought of as an object - a box or framework
- Following is a brief characterization of 8 *different views* on asset management
- These views make up the framework



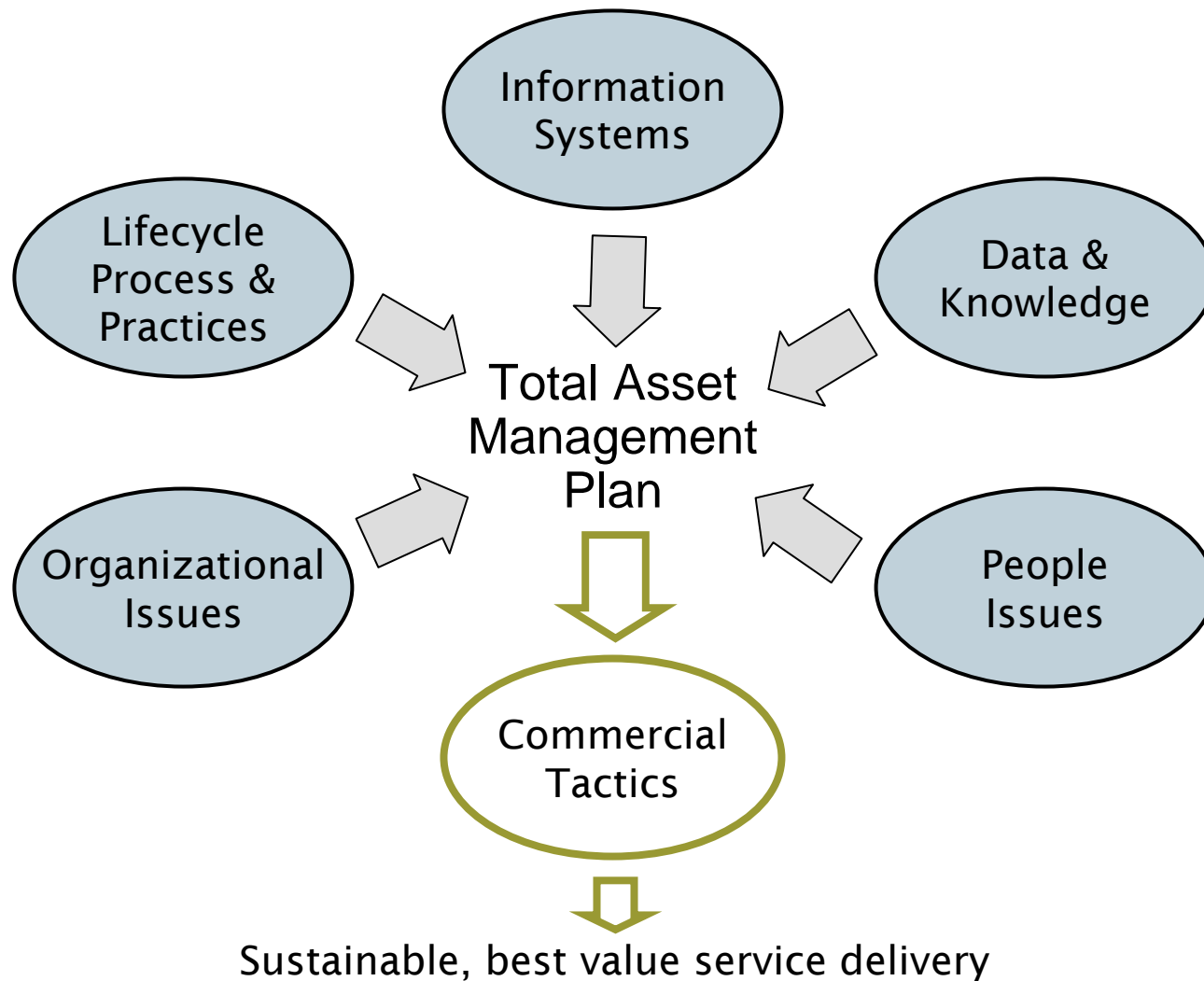
## View 1: Definition - asset management

- *Management paradigm* and *body of management practices*
- Applied to the *entire portfolio* of infrastructure assets at all levels of the organization
- Seeking to *minimize total costs* of acquiring, operating, maintaining, and renewing assets...
- Within an environment of *limited resources*
- While *continuously delivering the service levels* customers desire and regulators require
- At an acceptable level of *risk* to the organization

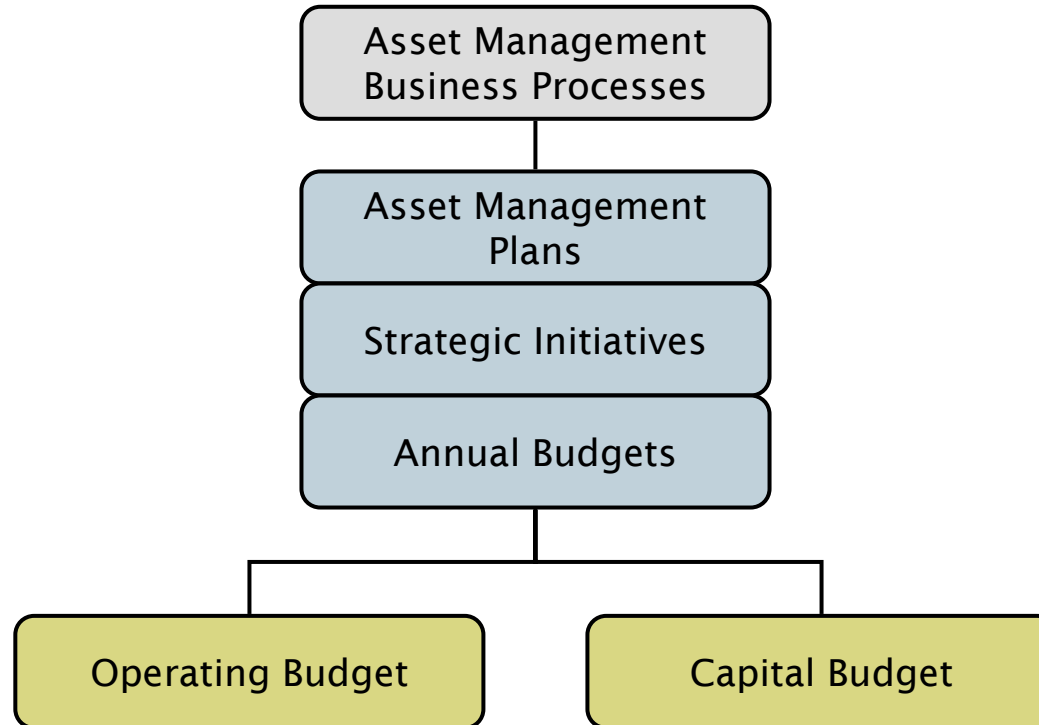
## View 2: Life cycle business processes



## View 3: Core AM program elements



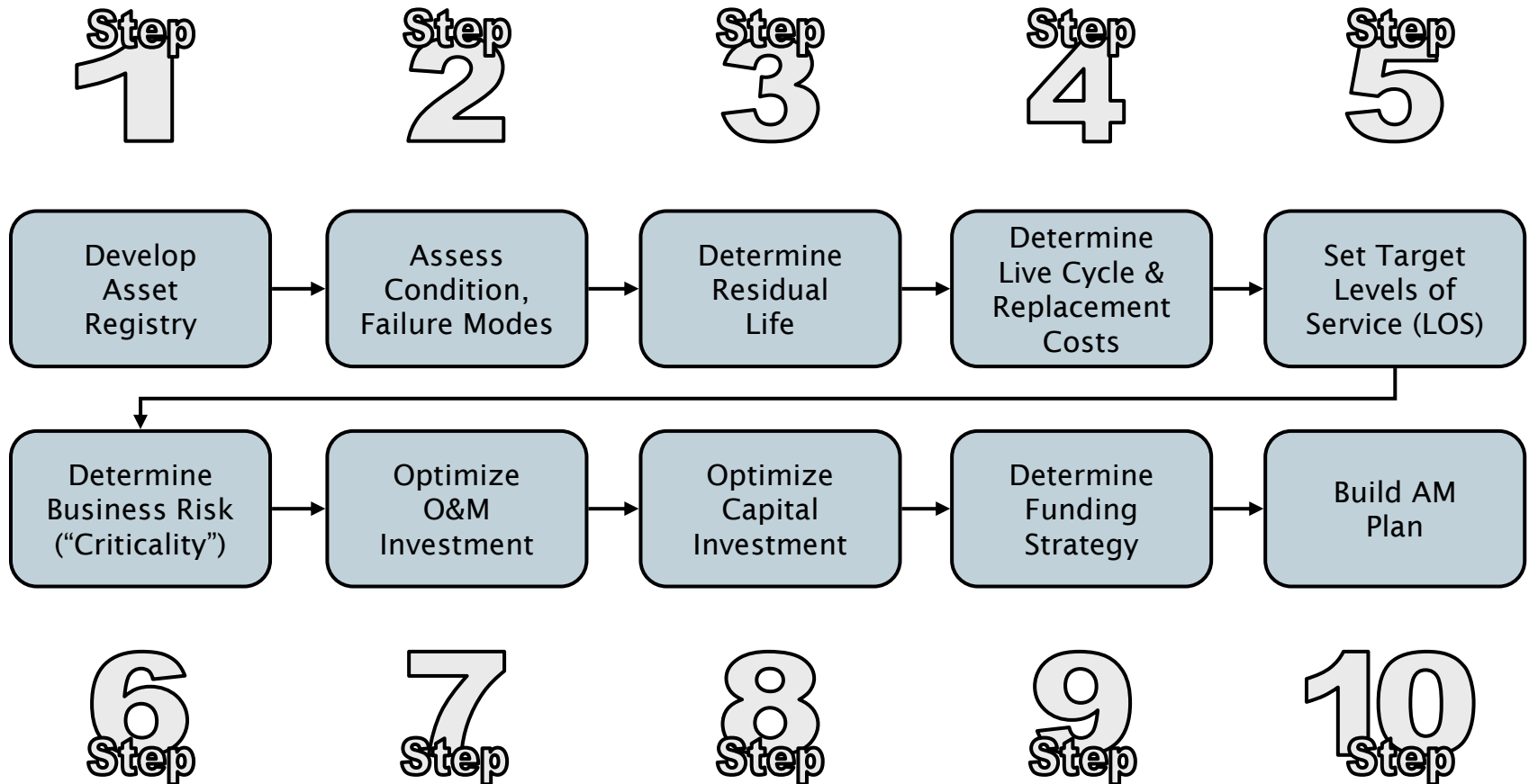
## View 4: Management framework



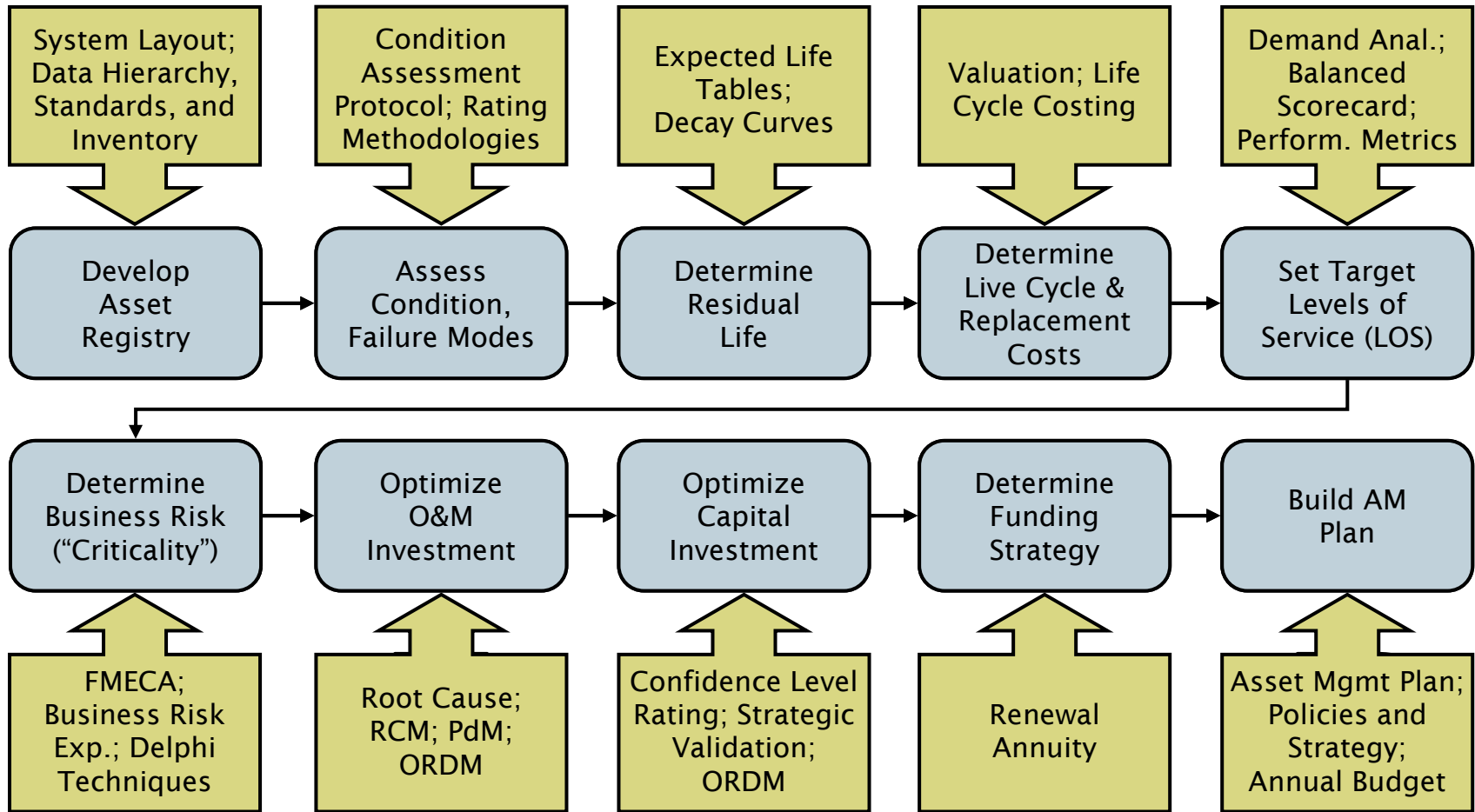
# View 5: Five core questions

1. What is the current state of my assets?
  - What do I own?
  - Where is it?
  - What condition is it in?
  - What is its remaining useful life?
  - What is its remaining economic value?
2. What is my required level of service (LOS)?
  - What is the demand for my services by my stakeholders?
  - What do regulators require?
  - What is my actual performance?
3. Which assets are critical to sustained performance?
  - How does it fail? How can it fail?
  - What is the likelihood of failure?
  - What does it cost to repair?
  - What are the consequences of failure?
4. What are my best O&M and CIP investment strategies?
  - What alternative management options exist?
  - Which are the most feasible for my organization?
5. What is my best long-term funding strategy?

## View 6: AM plan 10-step process



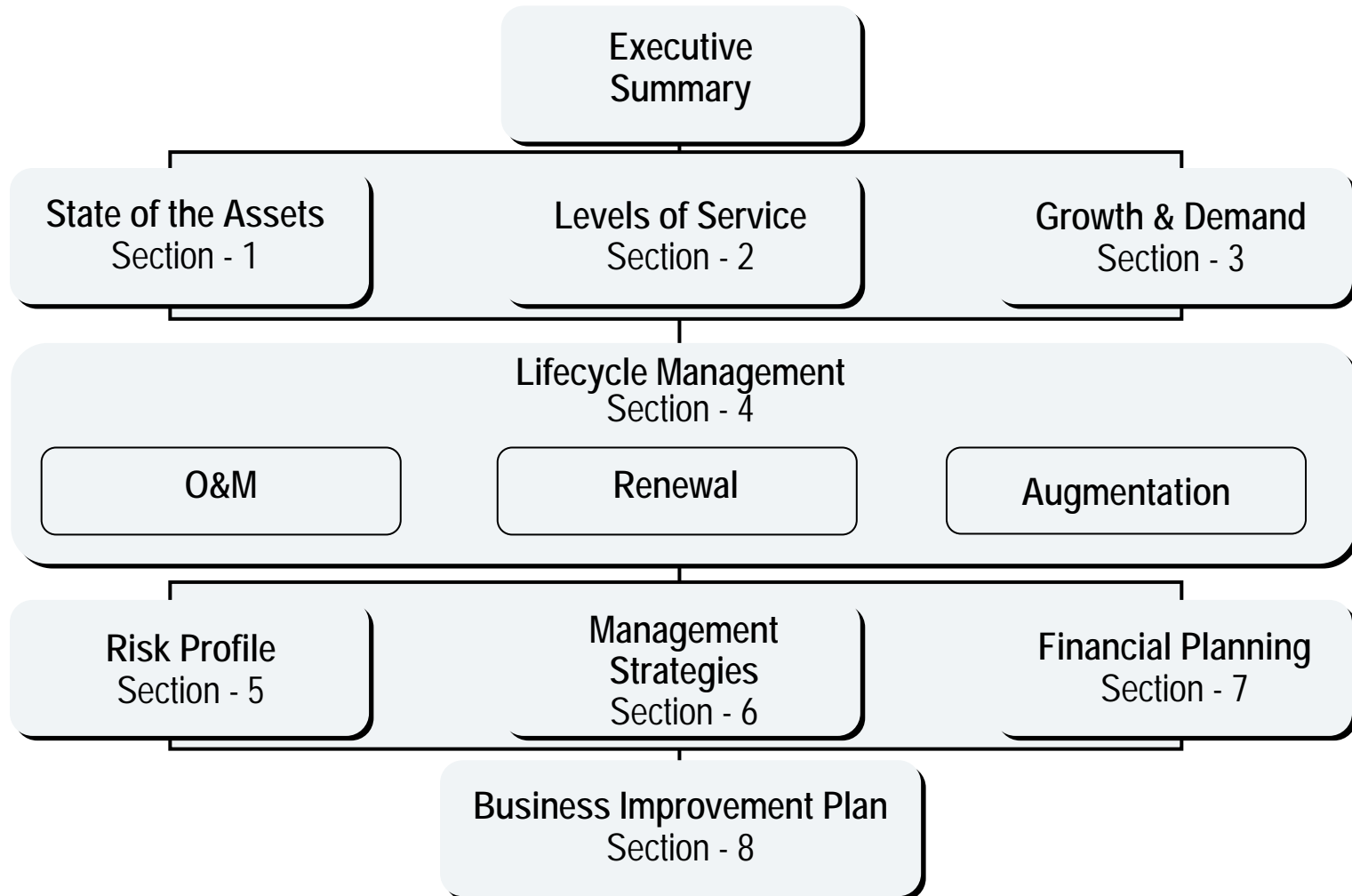
## View 6: AM plan 10-step process



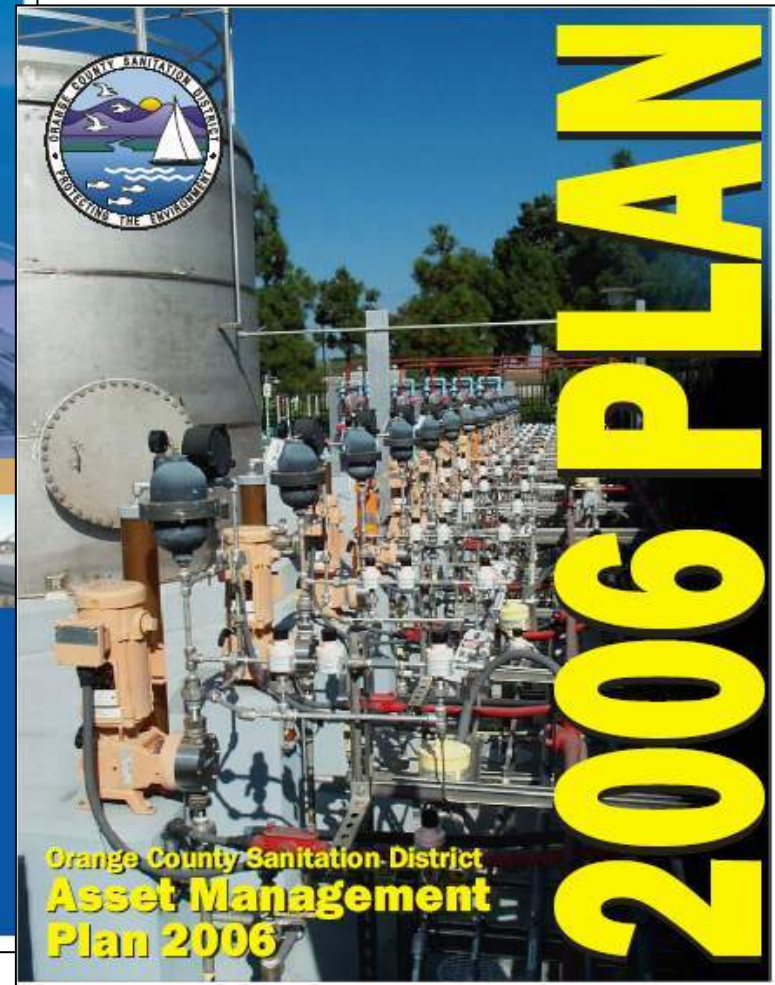
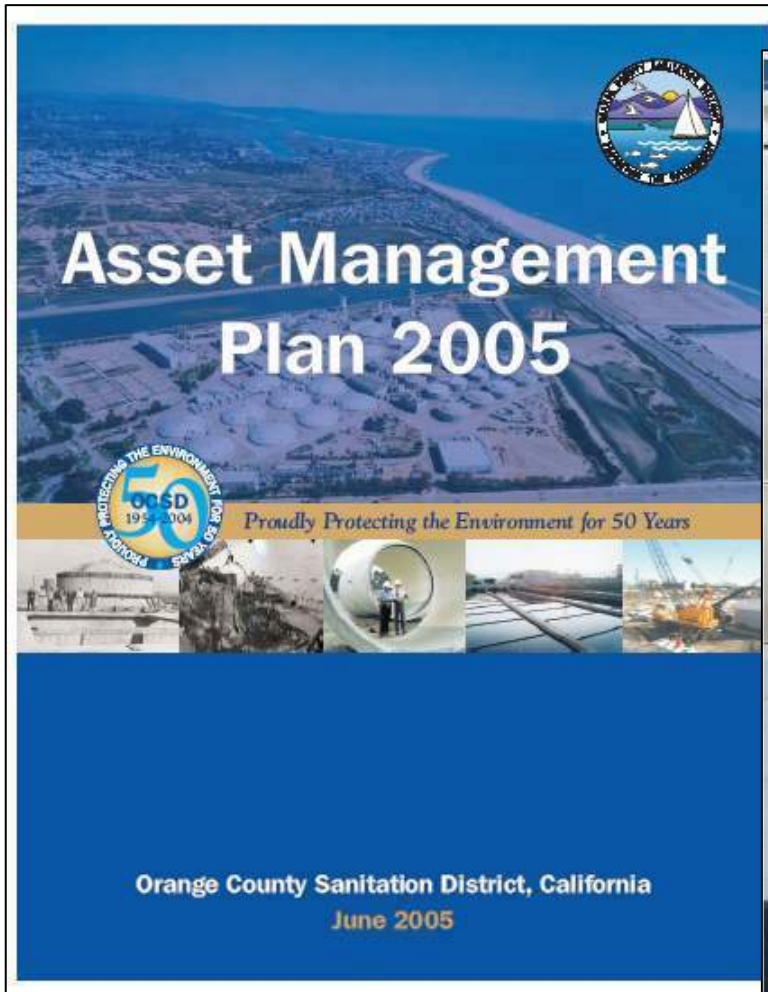
# View 7: Seven principles of asset management

1. The “Value Added/Level of Service” Principle—assets exist to deliver services and goods that are valued by the customer-stakeholder; for each consumer-stakeholder there is a minimum level of service below which a given service is not perceived as adding value.
2. The “Life Cycle” Principle—all assets pass through a discernable life cycle, the understanding of which enhances appropriate management.
3. The “Failure” Principle—usage and the operating environment work to break-down all assets; failure occurs when an asset can not do what is required by the user in its operating environment.
4. The “Failure Modes” Principle—not all assets fail in the same way.
5. The “Probability” Principle—not all assets fail at the same time.
6. The “Consequence” Principle—not all failures have the same consequences.
7. The “Total Cost of Ownership” Principle—there exists a minimum optimal investment over the life cycle of an asset that best balances performance and cost given a target level of service and a designated level of risk.

# View 8: Enterprise asset management plan



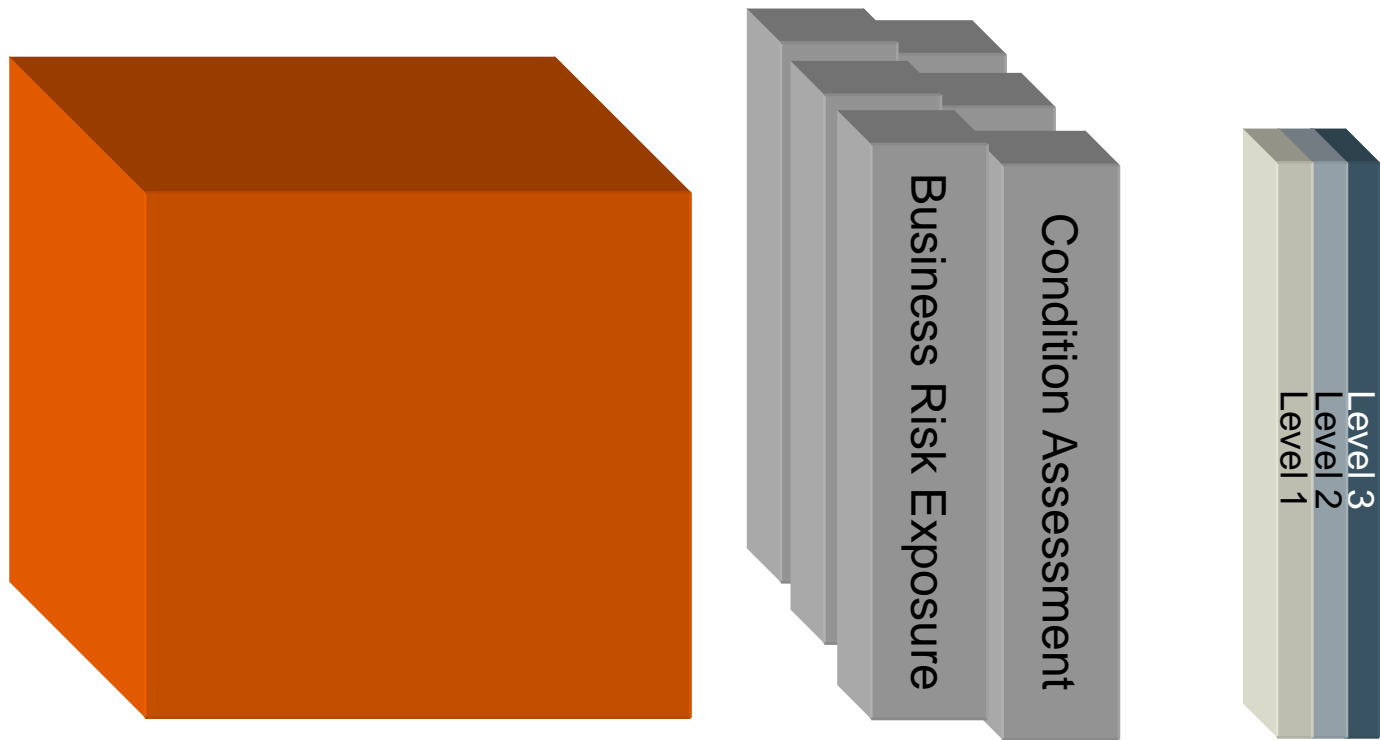
# The enterprise asset management plan



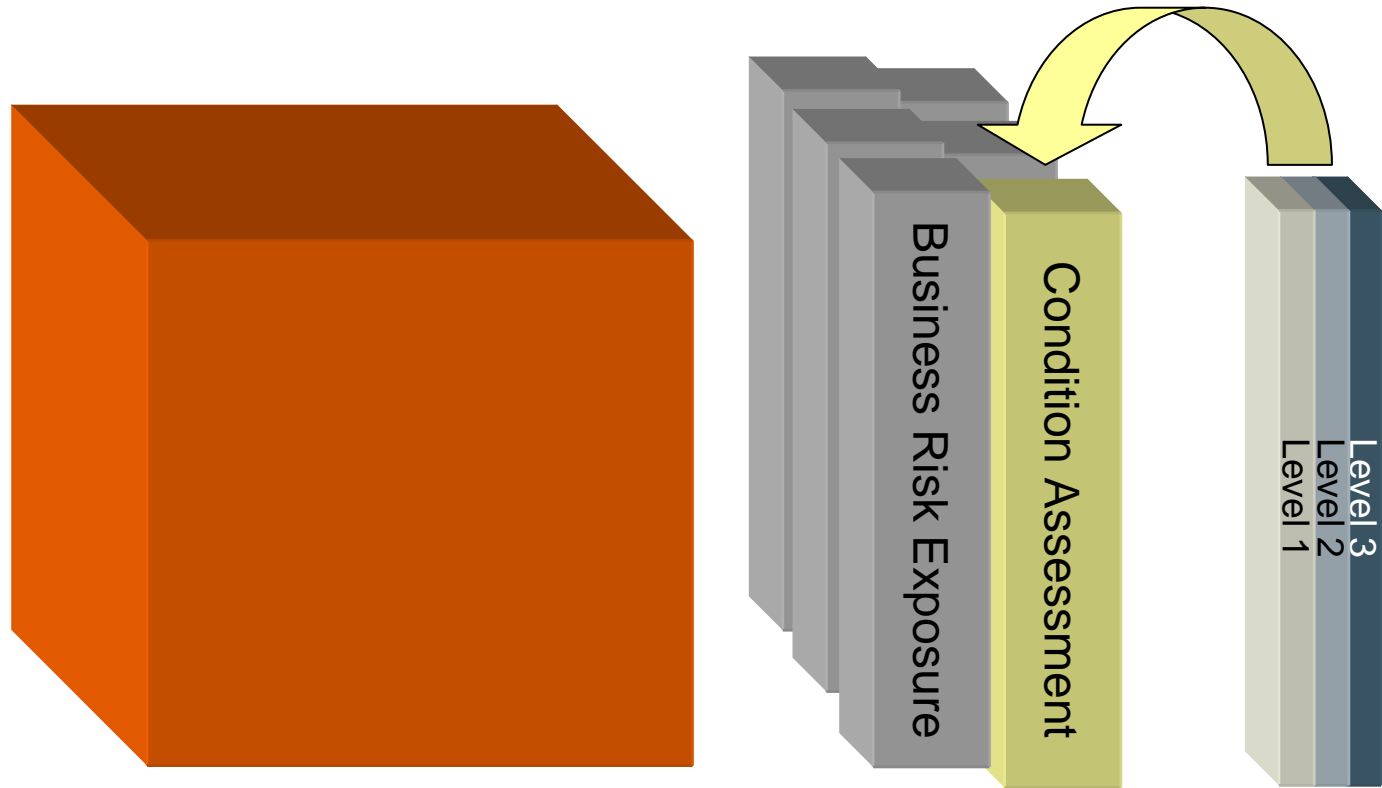
# Example of organizational AM strategies

Strategy	Objective/ Description	Related Service Standard
<b>Strategic Planning</b>		
<b>M.1 Organisational Structure</b>	<p>Manage the wastewater system through a structure that maintains a separation between asset management and service delivery to promote accountability, transparency and efficiency</p> <p>Asset management staff will be responsible for ensuring the Council achieves its objectives for wastewater services through setting, implementing, and monitoring of strategy and process.</p> <p>The actual delivery of wastewater services will be contracted, through competitive market mechanisms, to various service providers, who are concerned with the way the assets are operated and maintained in order to meet defined service standards.</p>	<p>Value for money</p> <p>Financial management</p> <p>Maintain service potential of assets</p>
<b>M.2 Human Resources</b>	<p>Develop the professional skills of the staff through adequate training and experience.</p> <p>Training needs will be agreed with staff each year at performance reviews and a register maintained to record training history. Staff are encouraged to belong to appropriate professional bodies and to attend appropriate conferences, seminars and training courses</p>	Value for money
<b>M.3 AM Plan Updates</b>	<p>The Asset Management Plans remain strategic 'living' documents and will be reviewed on a regular basis.</p> <p>The scope of the review will be influenced by changes in service standards, improved knowledge of assets, introduction of AM improvements and corporate strategy/ policy and process.</p> <p>The Wastewater Asset Manager, Policy Advisor and other senior management members will be involved in the plan review process.</p>	Legislative standards
<b>M.4 Risk Management</b>	<p>Manage risk exposure by completing an annual risk assessment to update the Wastewater Risk Management Plan and implement risk mitigation measures to maintain risk exposure at a level compatible with the Corporate risk policy.</p>	<p>Service continuity</p> <p>Service standards</p> <p>Financial standards</p>

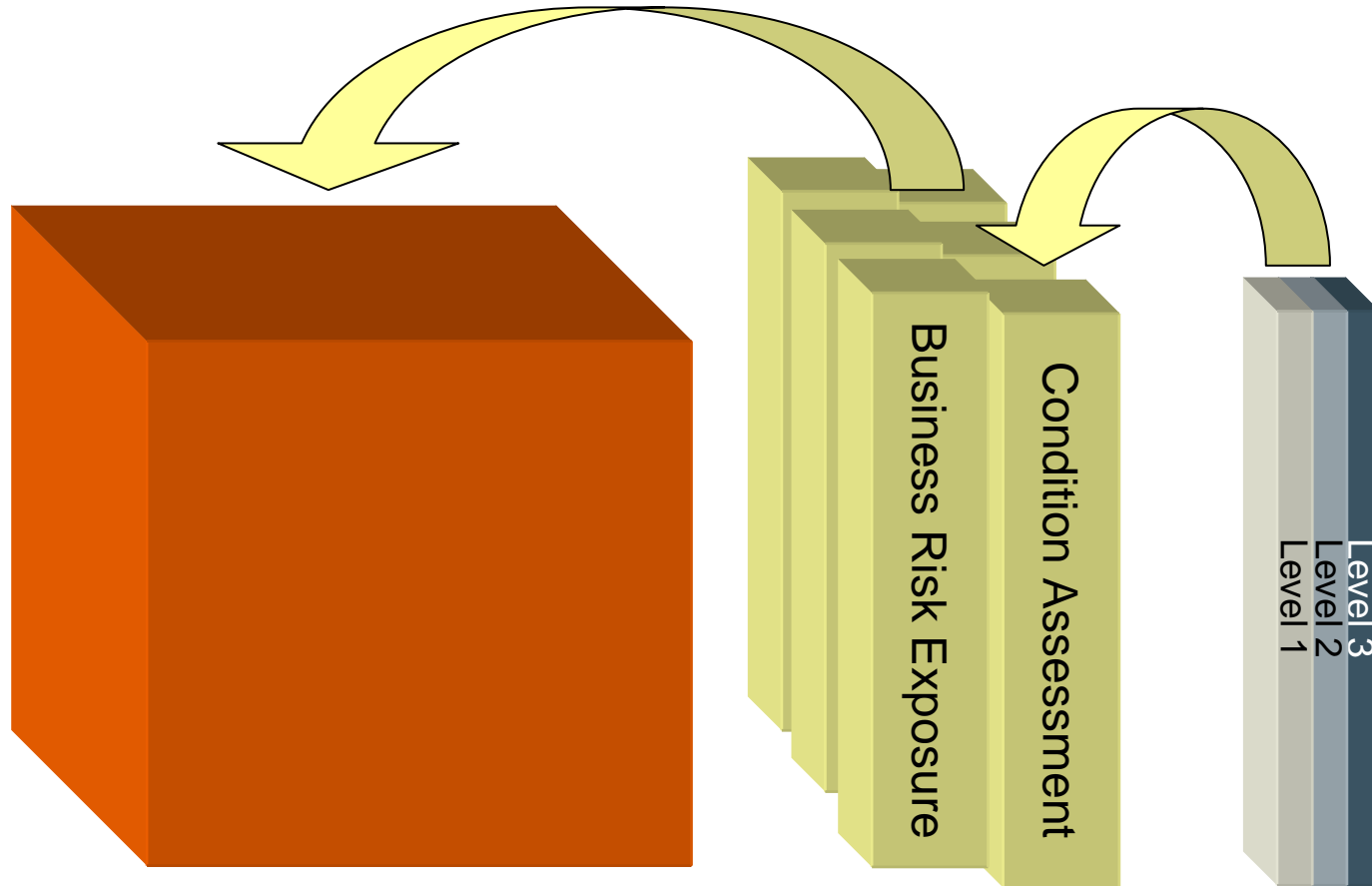
# Inside the AM framework



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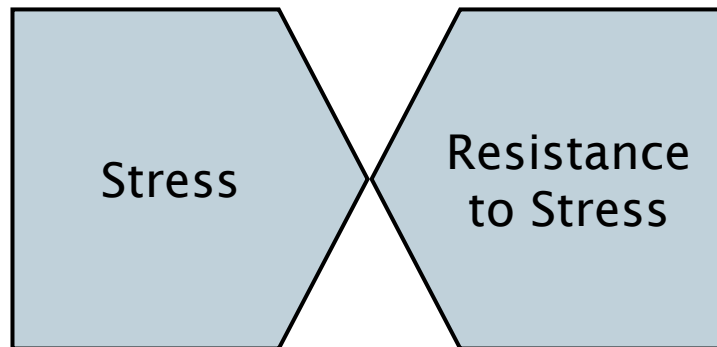
# Three fundamental management decisions

1. What are my work crews doing, where are they doing it—*and why*?
2. What CIP projects should be done—*and when*?
3. When should I *repair*, when should I *rehabilitate*, and when should I *replace*?

These decisions typically account for *over 80%* of a utility's annual expenditures

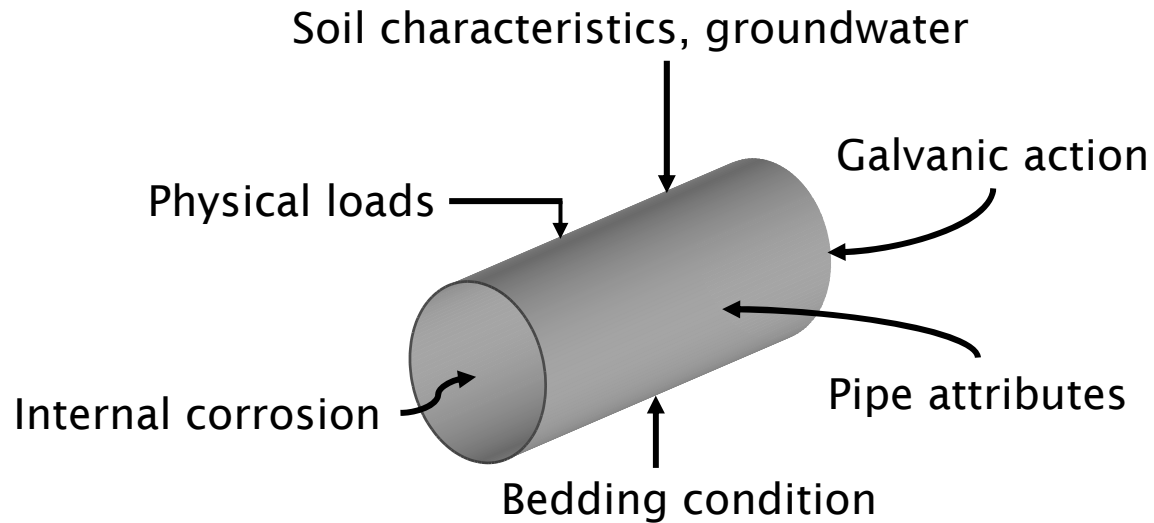
# Understanding how our assets fail

Yin-yang of asset failure



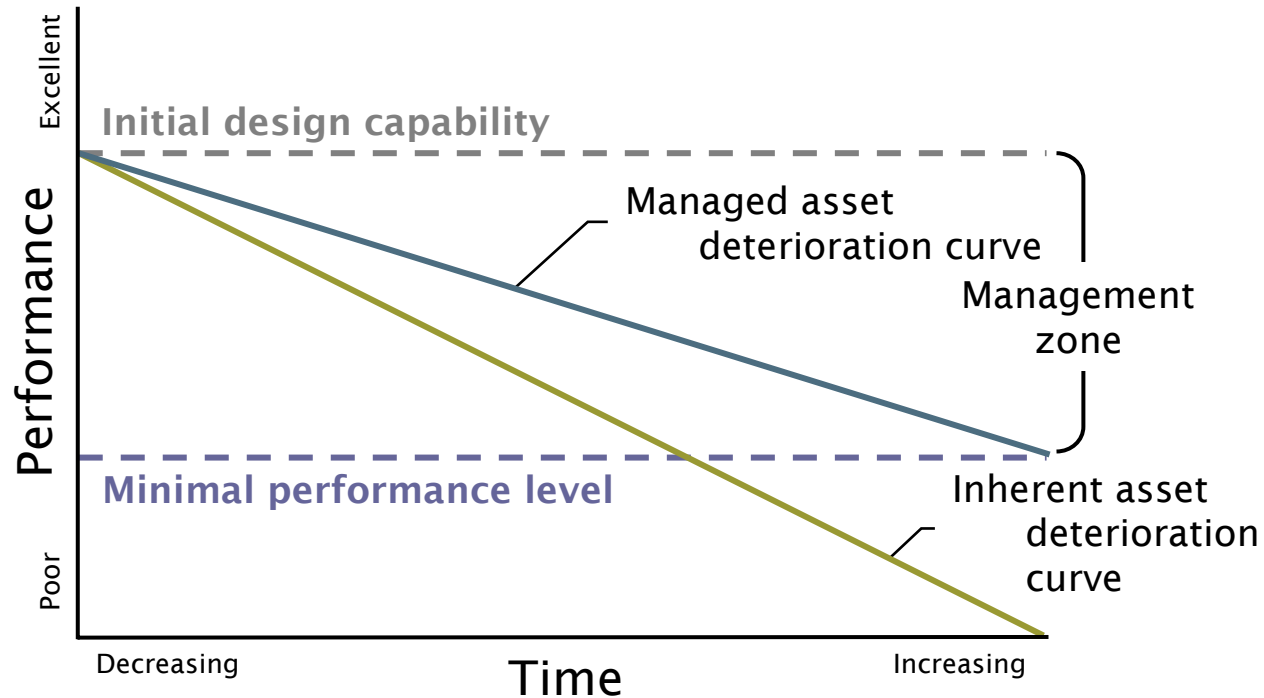
# Understanding how our assets fail

## Pipe failure



# Understanding how our assets fail

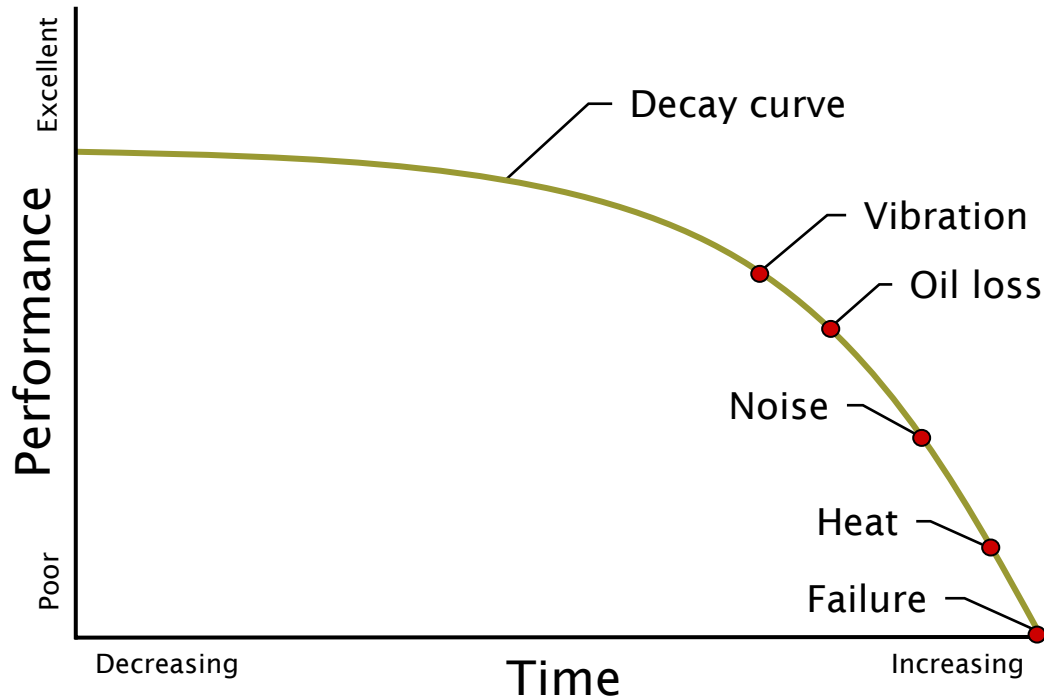
## Managing asset deterioration



“Failure is...the inability of any asset to do what users want it to do.”  
John Moubray

# Understanding how our assets fail

Monitoring performance is a key to reliability



# Understanding how our assets fail

Experience indicates...

- Failure can be subjected to systematic study – a science
- *30-70%* of equipment maintenance activity is typically *misdirected – it is not cost effectively deterring failure*

# Understanding how our assets fail

From the science of failure - tools for *proactive* management

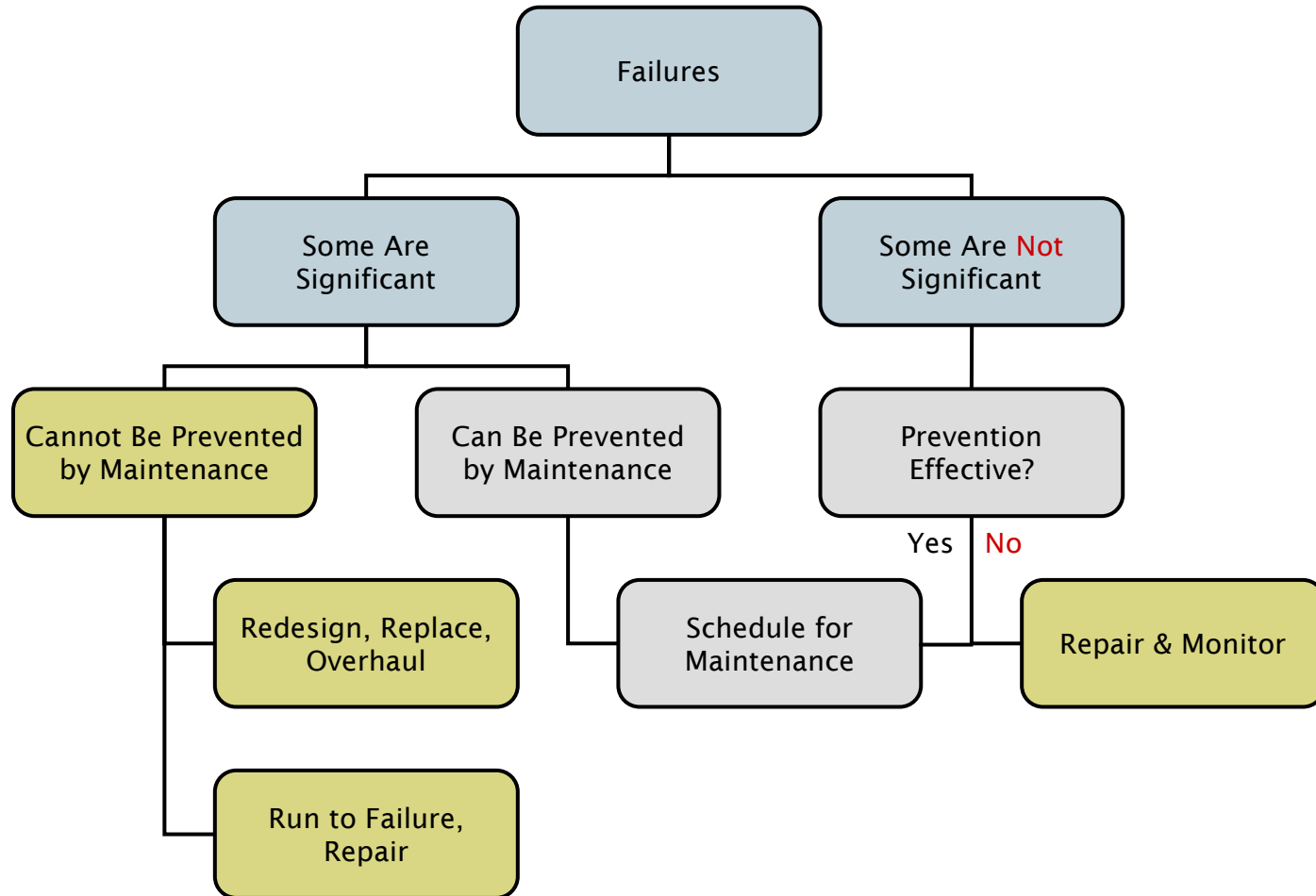
- Root cause analysis
- Failure mode, effects, and criticality analysis (FMECA)
- Condition-based monitoring, failure/survival curves
- Predictive maintenance (PdM)
- Proactive maintenance (zero breakdown, reliability centered maintenance, total productive maintenance)
- Reliability centered management (design, O&M)

AM is all about *managing the potential to fail*

# Our investment *toolkit*

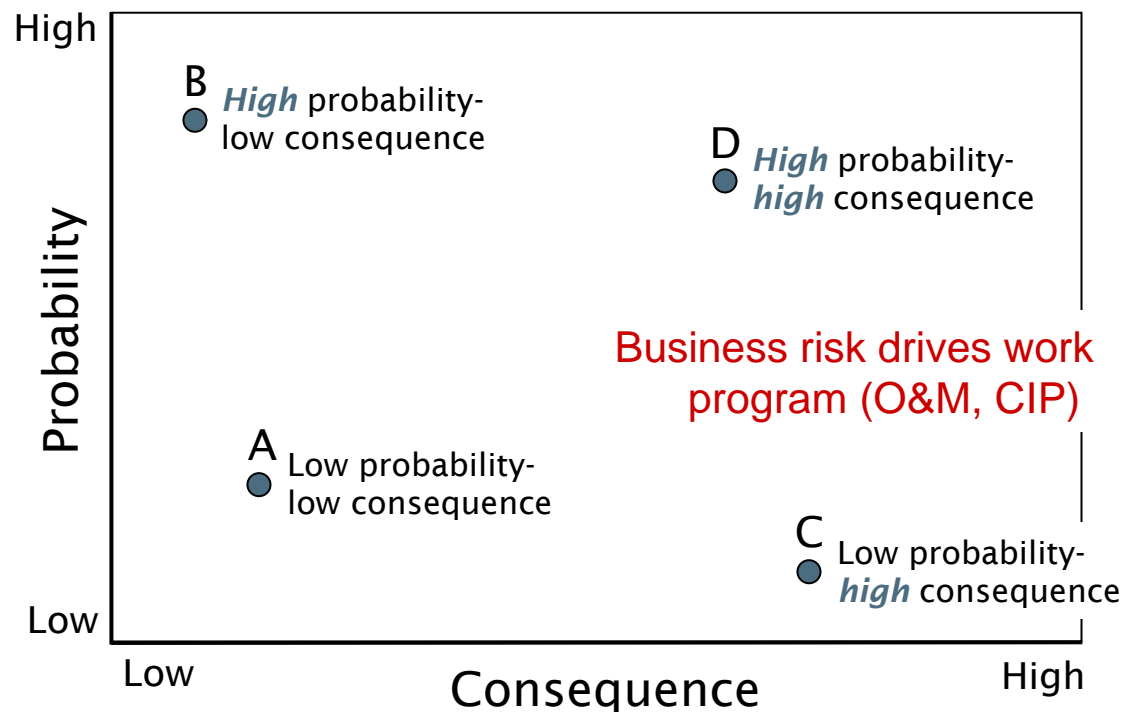
- Maintenance
- Renewal:
  - **Repair** – repair beyond normal periodic maintenance, relatively minor in nature, anticipated in the long-term operation of the asset; no enhancement of capabilities; typically funded by operating budget
  - **Refurbish/Rehabilitate**– replacement of a component part or parts or equivalent intervention sufficient to return the asset to level of performance above minimum acceptable level; may include minor enhancement of capabilities; typically funded out of capital budgets
  - **Replace**
    - **Without enhancement** – substitution of an entire asset with a new or equivalent asset without enhancement of capabilities
    - **With enhancement** - substitution of an entire asset with a new or equivalent asset with enhanced capabilities
- “Augmentation”

# Failure mode-based management logic

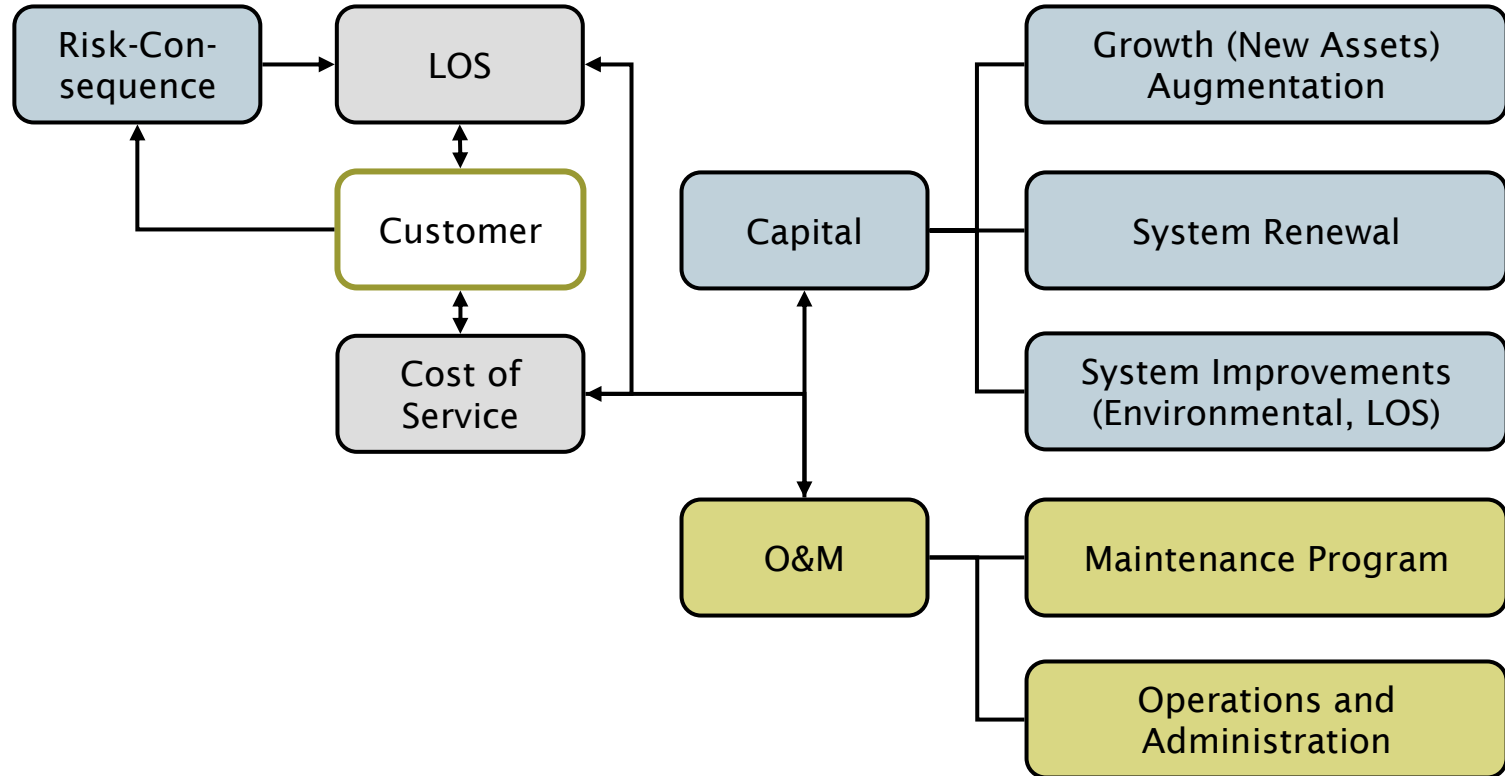


# Determining significant failures

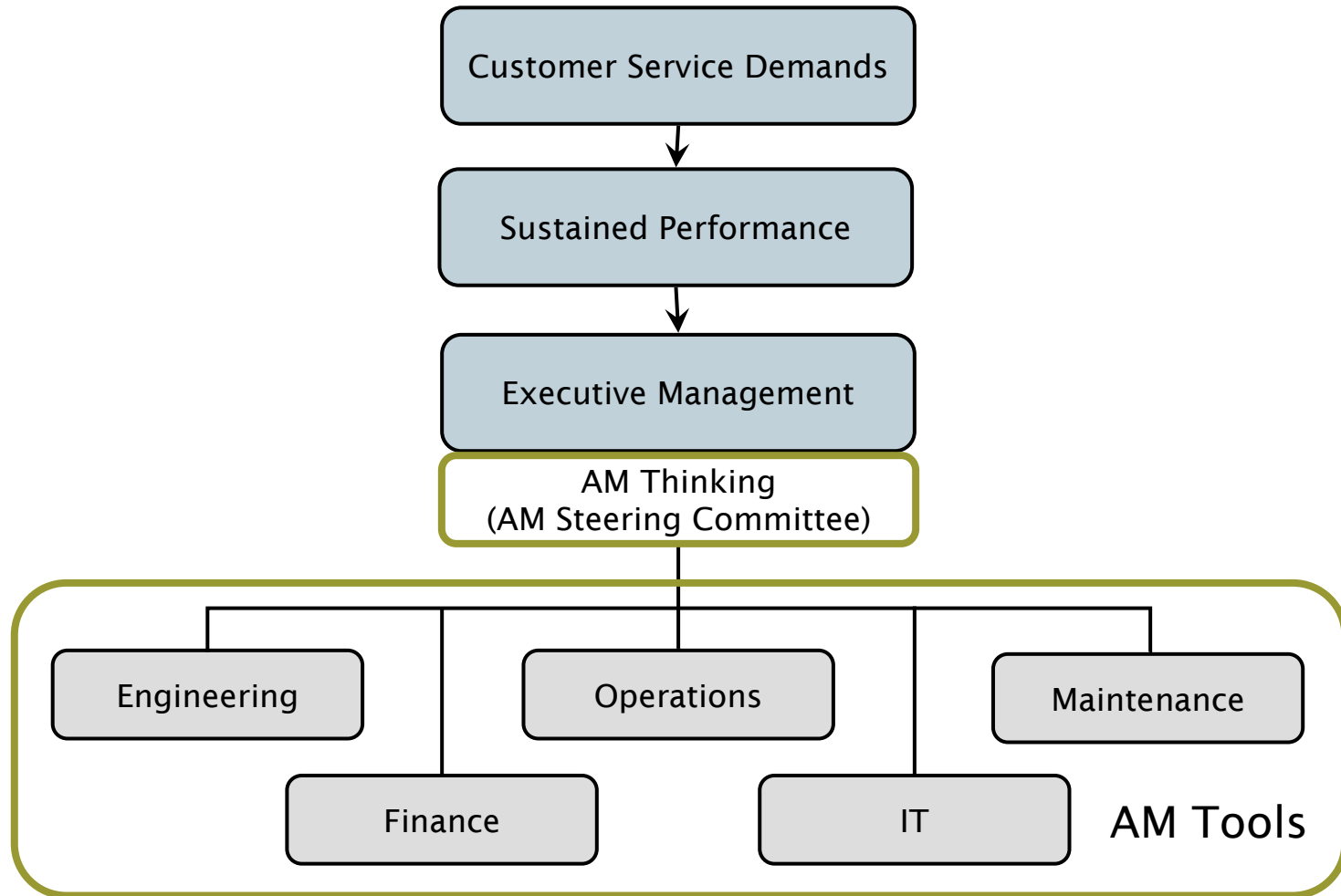
What is probability of failure? What is consequence of failure?



# The big picture



# AM-oriented structure



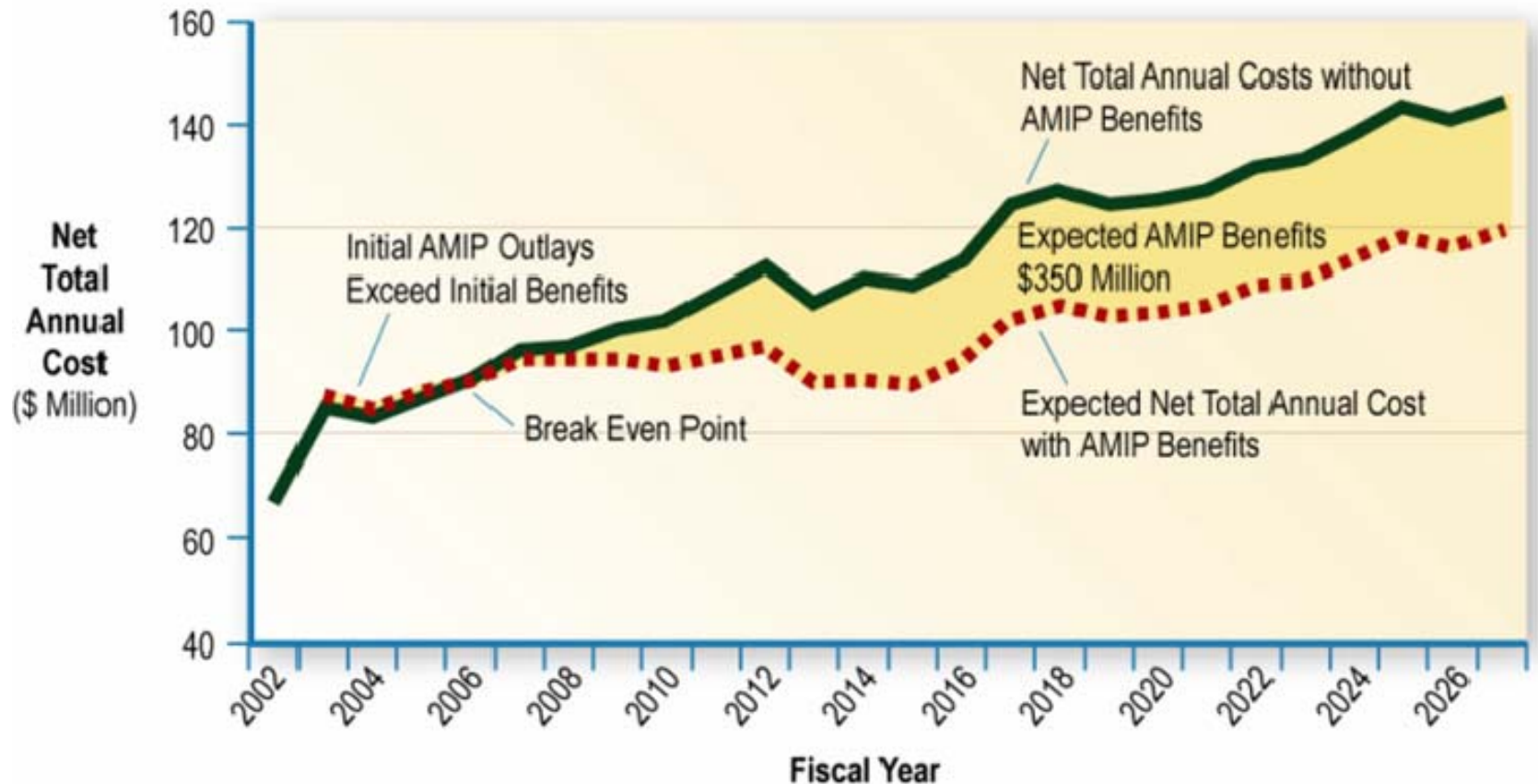
# AM-based decisions produce real *savings*

From assessment of Australia's advanced management practices, *20-30%* future life cycle cost *savings* typically is achievable for US water and wastewater utilities

Where savings develop from...

- Efficiency gains
- Cost avoidance (defer, eliminate, reduce)
- Cost effectiveness and redirection

# Making business case for AM

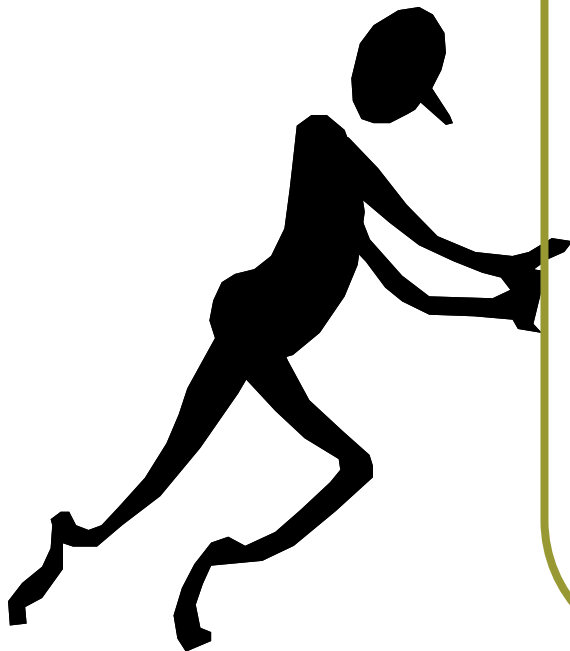


# AM payoffs

- Reduced life cycle costs from better-focused (redirected) resource use
- Better value-per-dollar spending
- Confidence in decision-making

The right work,  
the right investment,  
at the right time,  
for the right  
reasons.

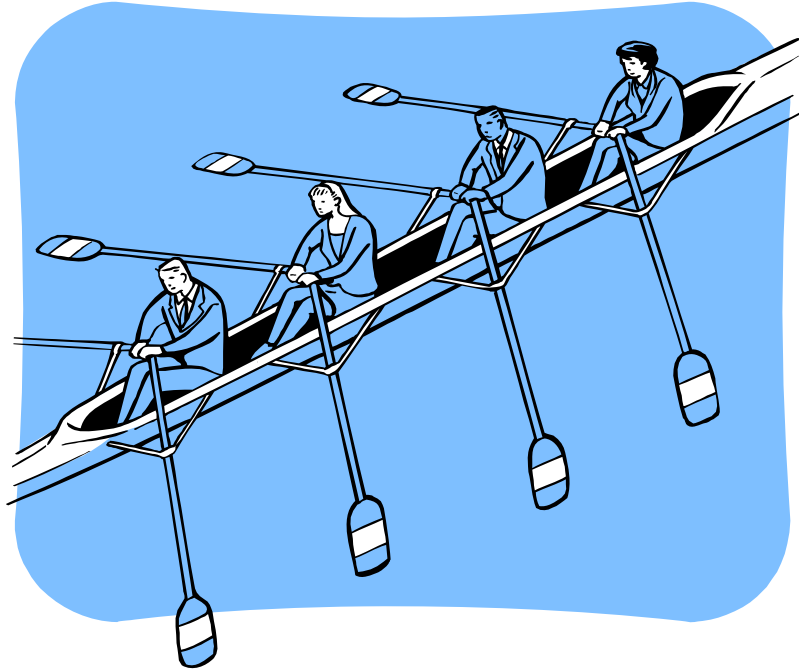
# Realistic expectations for AM



- Takes several years of detailed, *nitty-gritty work* to fully deploy
- Requires eventual *buy-in* commitment of the whole organization
- Needs *upfront* investment to get started, with *hidden* returns for initial years

# AM is a business model...

- *What* we do
- *Why* we do it
- *How* we do it
- *Where* we invest
- What our *costs* are
- What our *return* is



## Tom's bad day...



# Tom's spreadsheet

Storyline:

A Step-By-Step Asset Management

Prologue

It's twilight. Night is on the 40's. Tom is standing on the street. An old pick-up truck and has hit the power lines and is hanging up at any moment with their whine to the din.

His emergency response team is waiting for an electrician to pump station's motor or they wait, they would force main to divert the can not be found in a warehouse. June, the owner, and asks the owner.

Meanwhile the size of the drain and from there in the river is the sole water make matters worse, up-stream local industrial wastewater backups.

This, unfortunately, is a problem in a control problem. The third fall main from a 50 year significant wastewater also caused wastewater made the six o'clock ne.

Tom has been a City Supervisor, was promoted

Microsoft Excel - EPA Seminar Master.xls

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What is the State of My Assets?						Required LOS?		Which Are Most "Critical"?			
Installed Date	Asset Class	Original Cost	Estimated Effective Life	Condition Rating	Annual Dep	Accum Dep	Current LOS?	Minimum Condition	Backup Reduction (Redundancy)	Probability of Failure	Consequence of Failure
Year		\$	Years	1 to 10	\$	\$			%	Rating	1 to 10
Act or Est	Tab A	Act or Est	Calculated	Tab A	Calculated	Calculated		Tab A	Tab D	Calculated	Tab C
Sanitation System											
Disposal System											
Treatment Plants											
Collection Systems											
Sewer Mains											
Pump Station											
Incoming Sewer											
1963	3	\$ 1,725	100	6	\$ 17	\$ 742		2	0%	4	5
1963	3	\$ 340	100	5	\$ 3	\$ 146		2	0%	4	5
1986	5	\$ 442	30	8	\$ 15	\$ 295		2	0%	7	5
Incoming Power											
Pole & Transformer Connection											
2006	4	\$ -	40	1	\$ -	\$ -		2	0%	0	5
2006	7	\$ -	35	1	\$ -	\$ -		2	0%	0	5
Control system											
Incoming Telephone											
1985	8	\$ 85	25	7	\$ 3	\$ 71		2	0%	8	2
1983	8	\$ 8,600	25	8	\$ 344	\$ 7,912		2	0%	9	2
1978	8	\$ 425	25	7	\$ 17	\$ 476		2	50%	5	2
Land & Improvements											
Land											
1950	10	\$ 630	300	1	\$ 2	\$ 118		4	0%	2	1
1963	1	\$ 12,500	75	5	\$ 167	\$ 7,167		4	0%	6	1
2000	1	\$ 595	75	6	\$ 8	\$ 48		3	0%	1	1
1963	1	\$ 1,360	75	7	\$ 18	\$ 780		2	0%	6	3
Sub Structure											
Cassion Outer											
1963	1	\$ 30,600	75	6	\$ 408	\$ 17,544		3	0%	6	4
1963	1	\$ 4,250	75	6	\$ 57	\$ 2,437		3	0%	6	4
1963	1	\$ 6,800	75	6	\$ 91	\$ 3,899		3	0%	6	4
1963	9	\$ 4,250	60	7	\$ 71	\$ 3,046		2	0%	7	4
1963	1	\$ 5,100	75	6	\$ 68	\$ 2,924		3	0%	6	4
1963	1	\$ 850	75	6	\$ 11	\$ 487		3	0%	6	3
1963	4	\$ 595	40	6	\$ 15	\$ 640		2	0%	10	4
Pumps											
Drive shafts											
2006	6	\$ 12,560	35	1	\$ 359	\$ -	peak 2100cfm	2	TBD	10	TBD
2006	4	\$ 29,750	40	1	\$ 744	\$ -		2	TBD	10	TBD

Ready

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start

Modules 2

Duncan Rose - Inbox ...

Webpage has expire...

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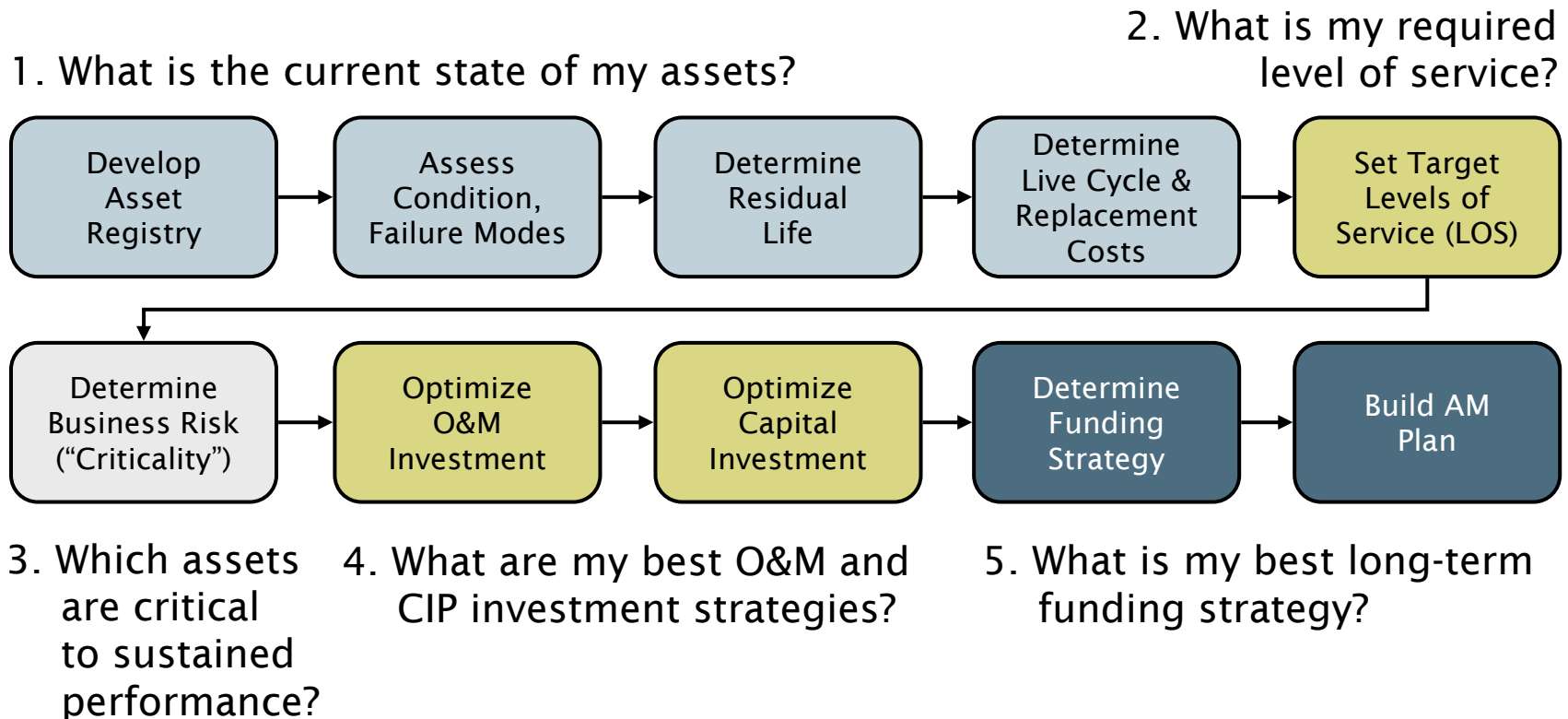
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Tuesday

4/10/2007

# Integration of 5 core questions with 10-step process



# The Bear and the Butterfly

